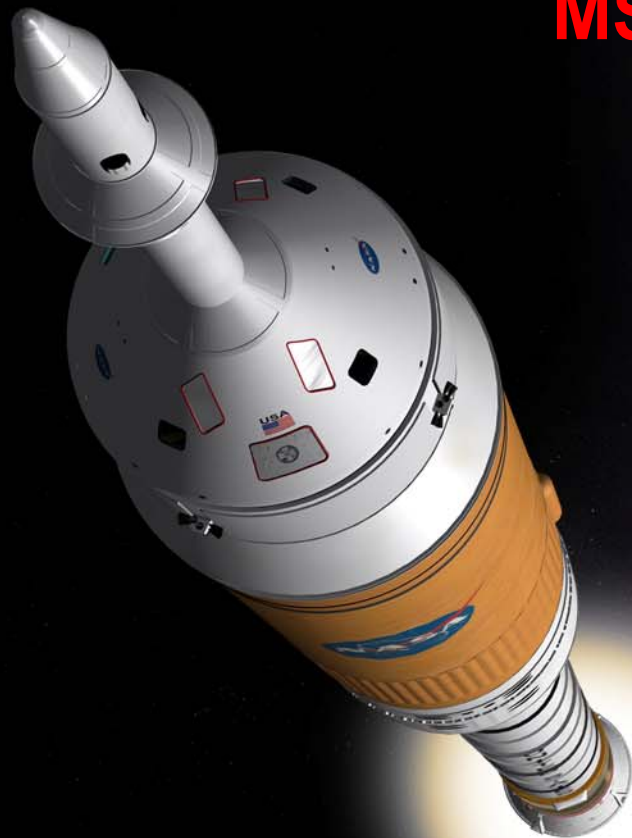




Process Improvement for Next Generation Space Flight Vehicles

MSFC Lessons Learned



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MSFC Lessons Learned Agenda

- Organizational Profile
- Process Improvement History
- Appraisal Preparation
- The Appraisal Experience ... Good, Bad, and Ugly
- Tools We Found Useful

Organizational Profile

NASA MSFC Flight & Ground Software Division

Appraisal Scope
3 Projects
2 Branches



- ✓ Human-Rated flight software used for Ares I Crew Launch Vehicle
- ✓ Requirements Definition

- ✓ Modular facility for materials science research in the micro-gravity environment of the International Space Station
- ✓ System Test

- ✓ Space Satellite Retirement
- ✓ Mission Support Modeling & Simulation
- ✓ Requirements Definition

Process Improvement History

**1st NASA Center to
Achieve CMMI Level 3**

**August 2007
Achieved CMMI Level 3**

**October 2005
Achieved CMMI Level 2**

**May 2003
Achieved CMM Level 3**

**December 2000
Achieved CMM Level 2**

**1st NASA Center to
Achieve CMM Level 2**

**1997 SPI Initiative
Began w/ SEI's CMM**

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Appraisal Preparation

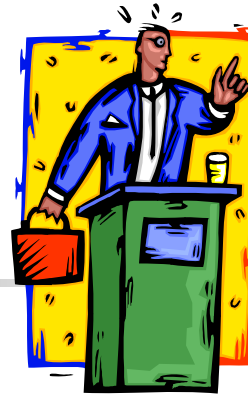
- Established early on relationship with Lead Appraiser
- Established sponsorship across departments
 - Management Steering Group
- PIID development and artifact collection
 - SEPG members responsible for
 - Populating PIIDs for assigned process areas
 - Interfacing with project teams to collect artifacts and work products relating to those process areas
 - SEPG-developed list of expected artifacts for generic practices helped facilitate consistency across organization
 - Internal review of PIIDs/artifacts (by SEPG and senior management) prior to the appraisal helped verify appraisal readiness

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Appraisal Preparation

- PIIDs and artifacts were maintained on a server for ease of access and review
 - One PIID file per project for each process area group
 - One PIID file for organizational process areas
 - For each practice of each Level 2 and Level 3 process area, PIIDs contained
 - File name of artifact (some links used)
 - Location reference for expected data (if not obvious)
 - Referenced artifacts were placed in project Software Development Library (SDL)
 - Minimum use of hardcopies

Appraisal Preparation



- Project Briefings
 - Developed standardized Project Briefing template
 - To address as many specific and generic practices as possible
 - Provide verbal affirmations for most of the practices – allowing many interviews to be cancelled
 - Conducted briefing dry runs (project and organizational)
 - Hardcopy of each briefing was on hand for reference

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Appraisal Preparation

- Interview preparation and training
 - Presented Interview do's and don'ts
 - Familiarized project teams with typical appraisal questions

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Appraisal Preparation

- Developed Appraisal Plan to identify
 - Team members
 - Interview schedule
 - Facility requirements
- Ensured facility readiness
 - Reserved and configured conference rooms
 - Identified required tools and verify availability
 - Provided necessary equipment/supplies

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The Appraisal Experience

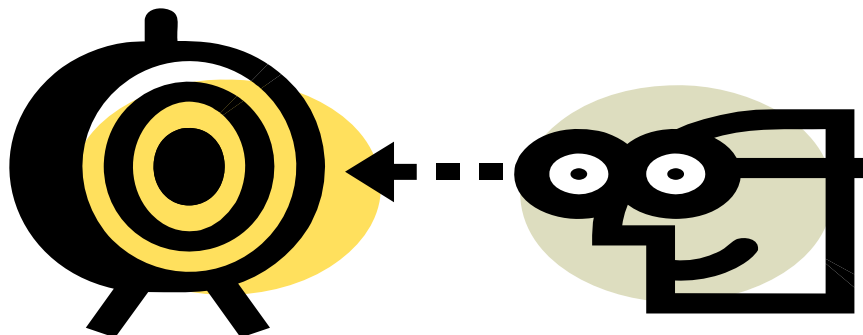
- What Worked ...
 - Strong Senior Management support
 - Well-established process improvement infrastructure
 - Project teams fully engaged
 - SEPG active and effective
 - One appraisal team instead of mini-teams
 - Provided experience depth/breadth
 - Consistency in evaluating practices and artifacts
 - Continuity in case team member had temporary conflict



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The Appraisal Experience

- More of What Worked ...
 - Appraisal preparation (time well spent)
 - Software Assurance participation
 - Product/Process Audits
 - SEPG and SRB support
 - Relationship with Lead Appraiser



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The Appraisal Experience

- Improvement opportunities ...
 - Employ an appraisal toolkit to reduce pain of PIID development
 - Accelerate institutionalization via checklist to identify work products appropriate for each life cycle phase
 - Conduct an internal mini-appraisal every year to determine the current state of the practice

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Useful Tools

- PIID reviews for each process area
- Detailed schedule
- Project briefing template
- Generic Practice institutionalization (list/chart)
- Templates and Checklists
- Written/verbal Affirmations
- SCAMPI Method (C, B, Readiness Review, A)

More Useful Tools

■ SDPDD Stakeholder Matrix

STAKEHOLDERS	INTERNAL													EXTERNAL				
	Division Management	Branch Management	Team Lead	Software Project Lead	Requirements Engineer	Design Engineer	Test engineer	Project CM Manager	SEPG	Metric Analyst	SRB	SCM Lead	Credit Card Holder	Project Office	IV&V (if applicable)	Software Assurance	MSFC Procurement Office	System Engineering
Reviews																		
System Requirements Review	R	P	P	P	P	P	P	P		K		K		P	P	P		P
Software Requirements Review	R	P	P	P	P	P	P	P		K		K		P	P	P		P
Critical Design Review	R	P	P	P	P	P	P	P		K		K		P	P	P		P
Organizational Work Products																		
Flight Software Branch Policy		S	R	R					C, U			K				R		
SPDDD	K	S	R	R	I	I	I	R	C, U	I	R, A	I				K		
Organizational Audit Plan		S	R	R	K	K	K	K	I	K	A	R				C		
Project Work Products																		
Software Data Dictionary		K		R	C, U	K	K	K		K	K	K		K	K	K		K
Software Design Description		K		R	K	C, U	K	K							K	K		
Software Development Plan		K		C, U	K	K	K	K	K		R, A	K		K	K	K		K
Processes and Activities																		
Action Items	K	R	R	A	R	R	R	R	R	R	R	R		K		K		
Estimation	K	R, A	R	R					R					K		K		
Decision Analysis and Resolution	I	R	R	R	K	K	K		K			K		K		K		

More Useful Tools

■ Level of Control Table (Data Mgt. Plan)

Level of Control (Baseline/Changes)	External	Software Project Date Baseline	Software Project M & C	SEPG M & C	SRB	SA	CM	FORMAT
Action Items			X	X				E, H
Charters				X				E, H
Checklists				X				E, H
Code ***					X		X	E
Coding Standards					X			E, H
Collaborative Work Committment (CW Cs)	X							E, H
Configuration Management Plan (CMP)					X			E, H
Project Schedule		X						E, H
Risk Management Plan (RMP)					X			E, H
Risk Sheets (SRA, SRQ)			X					E, H
Statment of Work (SOW)	X							E, H
Software Assurance Plan (SAP)					X			E, H
Software Assurance Audits						X		E, H
Software Change Requests			Type II**	Type I**				E, H
Software Change Requests (SA)						X**		E, H
Artifact Location	Project SDL	Project SDL	Project SDL	PAL	PAL	Server	PAL	

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Is CMMI Working?

- New projects are clearly reaping the benefits of past experience and lessons learned
- Better project planning due to more visibility into engineering life cycle processes
- Reduced training time and learning curve for new employees
- Better understanding of organizational and project interdependencies
- More awareness of stakeholder relationships and interfaces